AG Zeiner
Graz University of Technology
Institute for Chemical Engineering and Environmental Technology (CEET)

☐ Bachelor Thesis ☒ Theoretical

☐ Plant Design Practice (KÜ) ☐ Experimental

☒ Master Thesis ☐ Constructive

Topic: **Adaptive Meshing Refinement Algorithm for the Simulation of the Quasi-Incompressible Cahn-Hilliard/Navier-Stokes Equations**

In extraction columns **interfacial phenomena** have a major impact on the mass transfer between the governing multi-phase flows. **CFD models** for large scale plant simulations are using correlation formulas for **modeling multi-phase flows**. These correlation formulas are based on experimental data.

The combination of the **Cahn-Hilliard** [1] and the **Navier-Stokes** equations allow for the simulation of **droplet interactions** on small scales. Therefore, these simulations can provide a data-basis for correlation formulas and reduce experimental investigations. In the modeling process the **phase interface** and the mass transfer across the phase interface are resolved on a small scale.

However, the small dimensions of the liquid-liquid interface require a **fine computation mesh** which is not necessary in other regions of the flow field. The goal of this work is the implementation and testing of an **adapting mesh refinement** algorithm using an existing 2D CFD model. The program is carried out in MATLAB, depending on the work load an additional C++ program should be written.

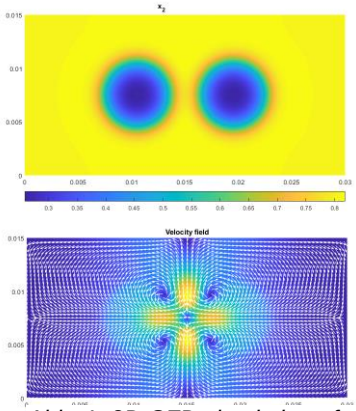

Abb. 1: 2D CFD simulation of two droplets coalesce

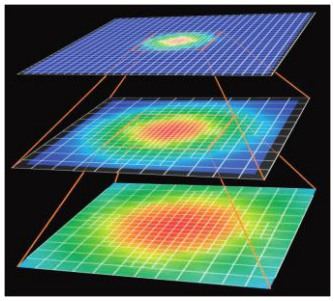

Abb. 2: Visualization of an adaptive mesh refinement [2]

Contact: Dipl.-Ing. Matthias Singer
CEET, Inffeldgasse 25/C/II, Room MC02008
Tel.: +43 (316) 873 – **4973**
Mail: matthias.singer@tugraz.at

Start: December 2021

Literature: [1] Cahn, J. W.; Hilliard, J. E. *Free Energy of a Nonuniform System. I. Interfacial Free Energy.* J. Chem. Phys. 1958, 28, 258-267.
[2] Matsumoto, M. et. al. *Implementation and Evaluation of an AMR Framework for FDM Applications.* Procedia Comput. Sci. 2014, 29, 936-946.